CUBIT Geometry

CUBIT User Workshop
Sandia National Labs
Jan. 21-22, 1997

Outline

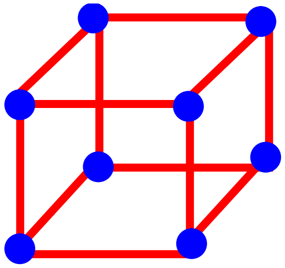
- Use of geometry in CUBIT
- Geometry creation
- Geometry import & export
- Geometry naming & identification
- Geometry transformations & booleans
- Non-manifold geometry
- Geometry demo

Use of Geometry in CUBIT

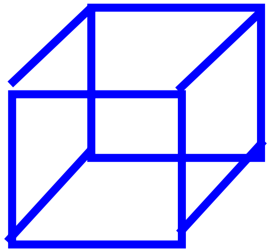
- Geometry is the *continuous* representation of the object being modeled; mesh is the *discretized* representation

- Topological entities in CUBIT:

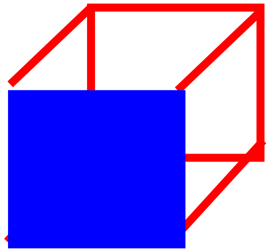
- Vertex



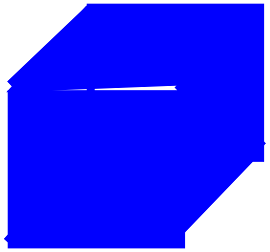
- Curve



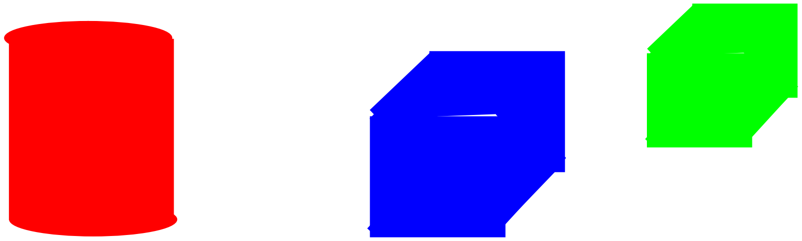
- Surface



- Volume

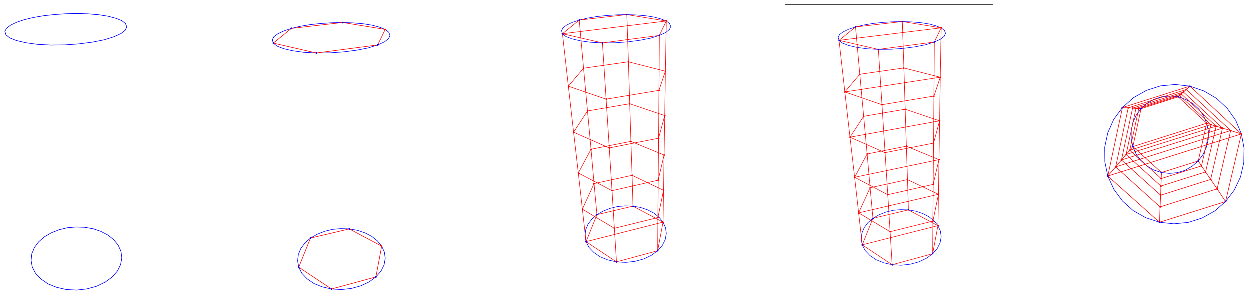


- Body



Use of Geometry in CUBIT (cont)

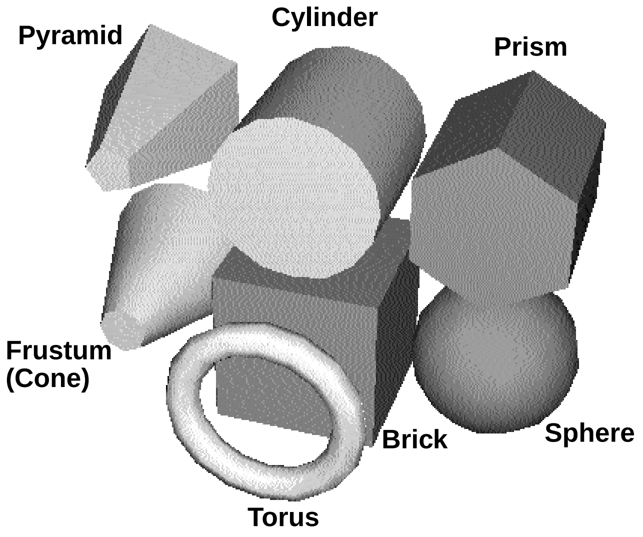
- **Geometry entities are approximated with mesh entities of same order**



- **Most user interaction in CUBIT will be with geometry entities, not mesh entities**
- **Geometry can be created inside CUBIT or imported from a file in ACIS or fastq formats**

Geometry Creation

- A limited set of primitive solids can be created within CUBIT



- These solids can be manipulated with booleans & transformations to create complex shapes
- However, CUBIT is not intended to be a fully capable CAD system; other software (Pro/E, SolidWorks, etc) is more appropriate for large models

Geometry Creation Syntax

- [create] brick x <x-dimension> [y <y-dim> z <z-dim>]
- [create] cylinder height <z-height> radius <x/y-radius>
- [create] prism height <z-height> sides <nsides> major [radius] <x-radius> minor [radius] <y-radius>
- [create] frustum z <z-height> major [radius] <x-radius> [minor [radius] <y-radius> top <top-x-radius>]
- [create] pyramid z <z-height> sides <nsides> major [radius] <x-radius>
  minor [radius] <y-radius> top <top-x-radius>
- [create] sphere radius <radius> [inner [radius] <inner_radius>] [delete] [xpositive] [ypositive] [zpositive]
- [create] torus major [radius] <major-radius> minor [radius] <minor-radius>

Geometry Import & Export

- Geometry can be imported directly in fastq and ACIS formats:

```
CUBIT> Import acis ‘acis-file-name’

CUBIT> Import fastq ‘fastq-file-name’
```

- ACIS geometry can be created in several ways:
  - Generate in Pro/Engineer & translate using Arlo Ames’ translator
  - Generate directly in AutoCAD, SolidWorks, SolidEdge, Aries, Trispectives, and HP SolidDesigner, and write ACIS directly
- ACIS geometry can also be written out from CUBIT:

```
CUBIT> Export acis ‘acis-file-name’
```

Geometry Naming & Identification

- Geometry is given id numbers; names can also be assigned:

```
CUBIT> Surface 1 name ‘frontsurf’
```

- Geometry can be identified by name or id number:

```
CUBIT> Surface 1 scheme pave

CUBIT> frontsurf scheme pave
```

- Aprepro function can be used to refer to last-created entity:

```
CUBIT> Create brick x 10

CUBIT> Volume {Id(“volume”)} name ‘firstbrick’
```

- Some useful id-related commands:

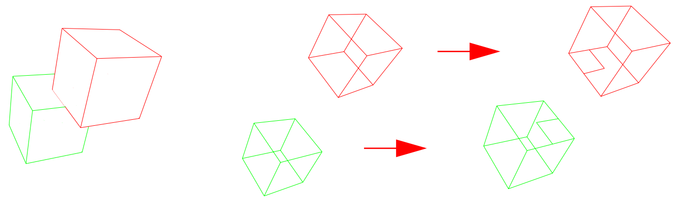
```
CUBIT> Compress ids

CUBIT> List {body|volume|surface|curve|vertex} ids
```

Geometry Transformations & Booleans (Applied to *Body*'s)

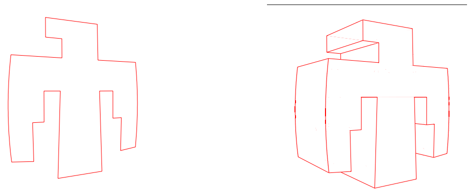
- Geometry transformations available in CUBIT:
  - Copy
  - Move
  - Scale
  - Reflect
  - Restore
- Geometry booleans available in CUBIT:

```
CUBIT> Subtract <body_id> from <body_id>

CUBIT> Unite <body_id> with <body_id>

CUBIT> Intersect <body_id> with <body_id>
```

- Other geometry operations available:
  - Imprint one body on another

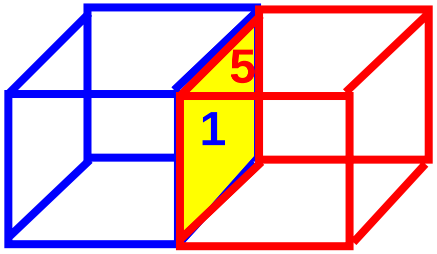


  - Sweep surface into solid*



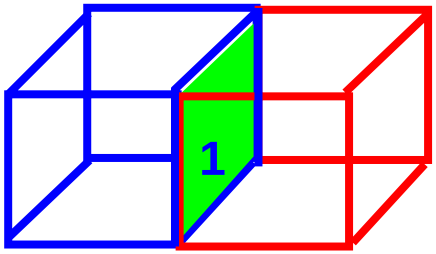
Non-manifold geometry

- When imported or created, geometry is *manifold*:



- To make a shared (*non-manifold*) surface, use:

```
CUBIT> merge all
```



- The details:
  - Vertices, curves and surfaces must all be co-incident
  - Geometry always exported as manifold model
  - Can do selective or de-selective merging
  - In general, do merging after *all* geometry operations

Geometry Demo

- **Journal file in ‘geomdemo.jou’**